

WHAT IS CLAIMED IS:

1. A method for detecting, identifying characterizing, purifying, obtaining structural information on, qualifying, screening, separating, fractionating and/or quantifying a Selective Androgen Receptor Modulator (SARM) compound in a sample, said method comprising the steps of:
 - 5 obtaining said sample; and
 - detecting the presence of said SARM compound in said sample;
 - 10 thereby identifying said SARM compound in said sample.
2. The method according to claim 1, wherein said sample is a biological sample.
3. The method according to claim 1, wherein said sample is a blood serum sample, a plasma sample, a urine sample, a CSF sample, a saliva sample, a fecal sample, an isolated or precipitated fraction, a protein adduct, or a protein extract.
4. The method according to claim 1, wherein said detection step comprises subjecting an aliquot from said sample to mass spectroscopy (MS), MS-MS, UV, IR, NMR, fluorescence, radiochemical detection, electrochemical detection, 15 chemiluminescent detection, evaporative light scatter detection (ESLD), hyphenated techniques or methods, or any combination thereof.
5. The method according to claim 1, wherein the detection step comprises measuring the UV absorbance of said SARM compound.
6. The method according to claim 1, wherein the detection step comprises 20 measuring the molecular ion peak of said SARM compound by mass spectrometry (MS).
7. The method according to claim 6, wherein said mass spectrometry is negative ion mass spectrometry.
8. The method according to claim 1, further comprising the step of 25 determining the concentration of said SARM in said sample by comparing the amount obtained from said sample with a reference sample comprising known amounts of a reference SARM compound.

9. The method according to claim 1, further comprising the step of subjecting said sample to a chromatographic separation prior to said detection step.

10. The method according to claim 9, wherein said chromatographic separation is by liquid chromatography (LC), High Performance Liquid Chromatography (HPLC), Thin Layer Chromatography (TLC), capillary electrophoresis (CE),
5 microLC electrophoresis, nano LC electrophoresis, gel electrophoresis (GE), isoelectric focusing gel electrophoresis, or by sample concentration.

11. The method according to claim 9, wherein said chromatographic separation is by liquid chromatography (LC), and said detection step comprises measuring the molecular ion peak of said SARM compound by mass spectrometry (MS).
10

12. The method according to claim 9, wherein said chromatographic separation is by High Performance Liquid Chromatography (HPLC), and said detection step comprises measuring the UV absorbance of said SARM compound.

13. The method according to claim 9, wherein said chromatographic separation is by liquid chromatography (LC), and said detection step comprises measuring the molecular ion peak of said SARM compound by MS-MS.
15

14. The method according to claim 9, wherein said chromatographic separation is by capillary electrophoresis (CE), and said detection step comprises measuring the molecular ion peak of said SARM compound by mass spectrometry (MS).
20

15. The method according to step 9, wherein the chromatographic separation comprises producing a chromatograph of said sample, said chromatograph comprising a series of peaks representing individual chemical compounds contained in said sample.

16. The method according to claim 15, further comprising the step of automatically collecting individual chemical compounds corresponding to peaks of said chromatograph into separate tubes.
25

17. The method according to claim 16, further comprising the step of detecting the presence of said SARM compound in an aliquot from each tube.

18. The method according to claim 17, wherein said detection step comprises subjecting each aliquot to mass spectroscopy (MS), MS-MS, UV, IR, NMR,
30 fluorescence, radiochemical detection, electrochemical detection,

chemiluminescent detection, evaporative light scatter detection (ESLD), hyphenated techniques or methods, or any combination thereof.

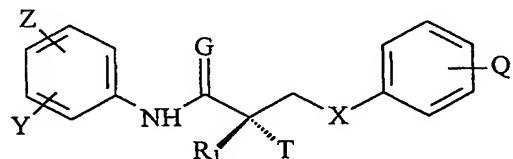
19. The method according to claim 17, wherein said detection step comprises measuring the UV absorbance of said SARM compound.

5 20. The method according to claim 17, wherein said detection step comprises measuring the molecular ion peak of said SARM compound by mass spectrometry.

21. The method according to claim 20, wherein said mass spectrometry is negative ion mass spectrometry.

10 22. The method according to claim 17, further comprising the step of determining the concentration of said SARM in each aliquot by comparing the amount of SARM obtained from said aliquot with a reference sample comprising known amounts of a reference SARM compound.

15 23. The method according to claim 1, wherein said SARM compound is a compound represented by the structure of formula I and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof



20

I

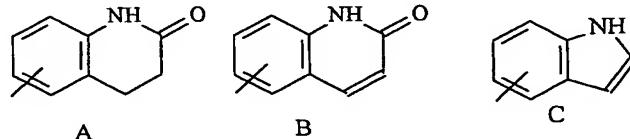
wherein

G is O or S;

X is a bond, O, CH₂, NH, Se, PR, NO or NR;T is OH, OR, -NHCOCH₃, or NHCORZ is NO₂, CN, COOH, COR, NHCOR or CONHR;Y is CF₃, F, I, Br, Cl, CN, CR₃ or SnR₃;Q is alkyl, halogen, CF₃, CN, CR₃, SnR₃, NR₂,NHCOCH₃, NHCOCF₃, NHCOR, NHCONHR,NHCOOR, OCONHR, CONHR, NHCSCH₃, NHCSCF₃,NHCSR, NHSO₂CH₃, NHSO₂R, OR, COR, OCOR,

30

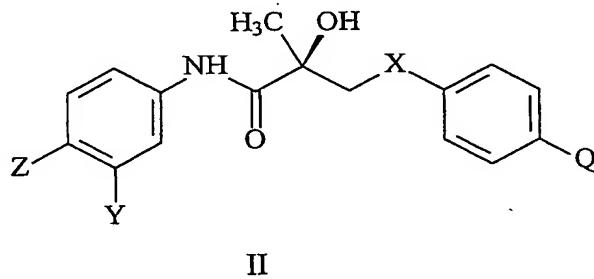
OSO₂R, SO₂R, SR, SCN, NCS, OCN, NCO; or Q together with the benzene ring to which it is attached is a fused ring system represented by structure A, B or C:



5 R is alkyl, haloalkyl, dihaloalkyl, trihaloalkyl, CH₂F, CHF₂, CF₃, CF₂CF₃, aryl, phenyl, halogen, alkenyl or OH; and

R₁ is CH₃, CH₂F, CHF₂, CF₃, CH₂CH₃, or CF₂CF₃.

10 24. The method according to claim 1, wherein said SARM compound is a compound represented by the structure of formula II and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof



15

II

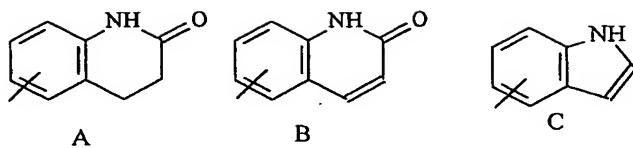
wherein X is a bond, O, CH₂, NH, Se, PR, NO or NR;

Z is NO₂, CN, COOH, COR, NHCOR or CONHR;

20 Y is CF₃, F, I, Br, Cl, CN, CR₃ or SnR₃;

Q is alkyl, halogen, CF₃, CN, CR₃, SnR₃, NR₂, NHCOCH₃, NHCOCF₃, NHCOR, NHCONHR, NHCOOR, OCONHR, CONHR, NHCSCH₃, NHCSCF₃, NHCSR, NHSO₂CH₃, NHSO₂R, OR, COR, OCOR, OSO₂R, SO₂R, SR, SCN, NCS, OCN, NCO; or Q together with the benzene ring to which it is attached is a fused ring system represented by structure A, B or C:

25

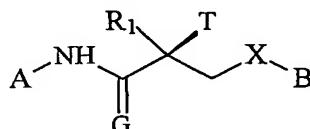


R is alkyl, haloalkyl, dihaloalkyl, trihaloalkyl, CH_2F , CHF_2 , CF_3 , CF_2CF_3 , aryl, phenyl, halogen, alkenyl or OH.

5

25. The method according to claim 1, wherein said SARM compound is a compound represented by the structure of formula III and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof

10



III

wherein X is a bond, O, CH_2 , NH, Se, PR, NO or NR;

G is O or S;

R_1 is CH_3 , CH_2F , CHF_2 , CF_3 , CH_2CH_3 , or CF_2CF_3 ;

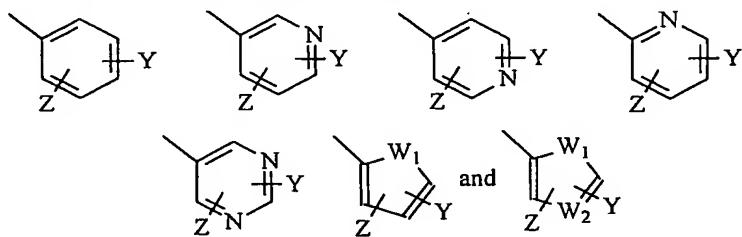
T is OH, OR, -NHCOCH₃, or NHCOR;

R is alkyl, haloalkyl, dihaloalkyl,

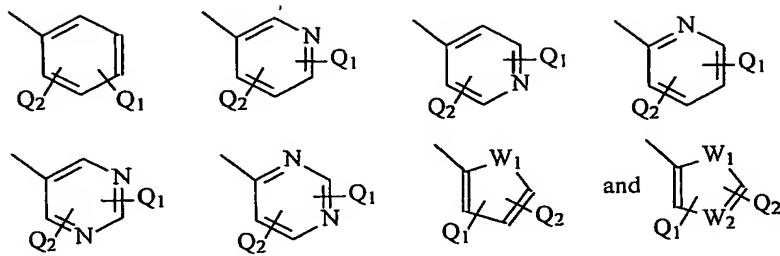
CH₂F, CHF₂, CF₃, CF₂CF₃, aryl, phenyl, halogen, alkenyl or OH;

20

A is a ring selected from:



B is a ring selected from:



wherein A and B cannot simultaneously be a benzene ring;

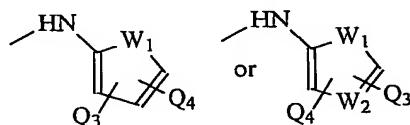
Z is NO_2 , CN, COOH, COR, NHCOR or CONHR;

Y is CF_3 , F, I, Br, Cl, CN CR_3 or SnR_3 ;

5

Q_1 and Q_2 are independently of each other a hydrogen, alkyl, halogen, CF_3 , CN CR_3 , SnR_3 , NR_2 , NHCOCH_3 , NHCOCF_3 , NHCOR, NHCONHR, NHCOOR, OCONHR, CONHR, NHCSCH_3 , NHCSCF_3 , NHCSR NHSO_2CH_3 , NHSO_2R , OR, COR, OCOR, OSO₂R, SO₂R, SR, SCN, NCS, OCN, NCO,

10



Q_3 and Q_4 are independently of each other a hydrogen, alkyl, halogen, CF_3 , CN CR_3 , SnR_3 , NR_2 , NHCOCH_3 , NHCOCF_3 , NHCOR, NHCONHR, NHCOOR, OCONHR, CONHR, NHCSCH_3 , NHCSCF_3 , NHCSR NHSO_2CH_3 , NHSO_2R , OR, COR, OCOR, OSO₂R, SO₂R or SR, SCN, NCS, OCN, NCO;

15

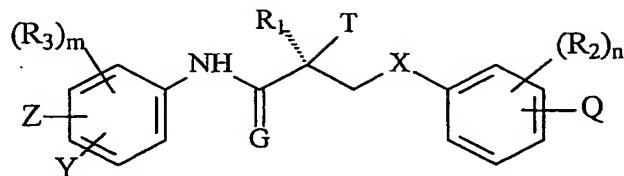
W_1 is O, NH, NR, NO or S; and

W_2 is N or NO.

20

26. The method according to claim 1, wherein said SARM compound is a compound represented by the structure of formula IV and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof

25



IV

wherein

X is a bond, O, CH_2 , NH, Se, PR, NO or NR;

G is O or S;

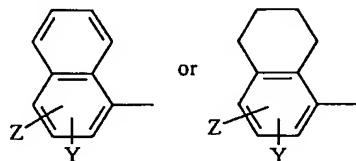
T is OH, OR, $-\text{NHCOCH}_3$, or NHCOR ;

R is alkyl, haloalkyl, dihaloalkyl, trihaloalkyl, CH_2F , CHF_2 , CF_3 , CF_2CF_3 , aryl, phenyl, halogen, alkenyl or OH;

R_1 is CH_3 , CH_2F , CHF_2 , CF_3 , CH_2CH_3 , or CF_2CF_3 ;

R_2 is F, Cl, Br, I, CH_3 , CF_3 , OH, CN, NO_2 , NHCOCH_3 , NHCOCF_3 , NHCOR , alkyl, arylalkyl, OR, NH_2 , NHR , NR_2 , SR, SCN, NCS, OCN, NCO;

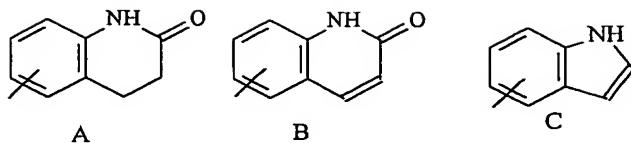
R_3 is F, Cl, Br, I, CN, NO_2 , COR, COOH, CONHR, CF_3 , SnR_3 , or R_3 together with the benzene ring to which it is attached forms a fused ring system represented by the structure:



Z is NO_2 , CN, COR, COOH, or CONHR;

Y is CF_3 , F, Br, Cl, I, CN, or SnR_3 ;

Q is H, alkyl, halogen, CF_3 , CN, CR₃, SnR_3 , NR_2 , NHCOCH_3 , NHCOCF_3 , NHCOR , NHCONHR , NHCOOR , OCONHR, CONHR, NHCSCH_3 , NHCSCF_3 , NHCSR , NHSO_2CH_3 , NHSO_2R , OH, OR, COR, OCOR, OSO₂R, SO₂R, SR; or Q together with the benzene ring to which it is attached is a fused ring system represented by structure A, B or C:

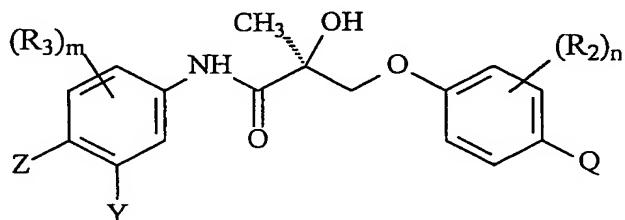


n is an integer of 1-4; and

m is an integer of 1-3.

5

27. The method according to claim 1, wherein said SARM compound is a compound represented by the structure of formula V and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof



V

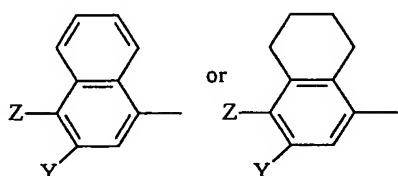
wherein

R_2 is F, Cl, Br, I, CH_3 , CF_3 , OH, CN, NO_2 ,

NHCOCH₃, NHCOCF₃, NHCOR, alkyl, arylalkyl, OR,

· NH₂, NHR, NR₂, SR;

R_3 is F, Cl, Br, I, CN, NO_2 , COR, COOH, CONHR, CF_3 , SnR_3 , or R_3 together with the benzene ring to which it is attached forms a fused ring system represented by the structure:

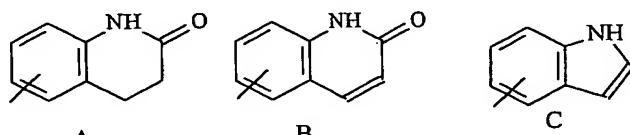


R is alkyl, haloalkyl, dihaloalkyl, trihaloalkyl, CH_2F , CHF_2 , CF_3 , CF_2CF_3 , aryl, phenyl, halogen, alkenyl or OH :

Z is NO_2 , CN, COR, COOH, or CONHR;

Y is CF_3 , F, Br, Cl, I, CN, or SnR_3 ;

5 Q is H, alkyl, halogen, CF_3 , CN, CR₃, SnR₃, NR₂,
 NHCOCH_3 , NHCOCF_3 , NHCOR , NHCONHR ,
 NHCOOR , OCONHR, CONHR, NHCSCl_3 , NHCSCF_3 ,
 NHCSR , NHSO_2CH_3 , NHSO_2R , OH, OR, COR, OCOR,
 OSO_2R , SO_2R , SR; or Q together with the benzene ring to
which it is attached is a fused ring system represented by
structure A, B or C:



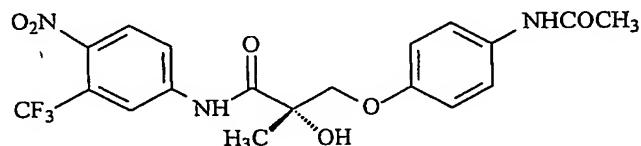
10

n is an integer of 1-4; and

m is an integer of 1-3.

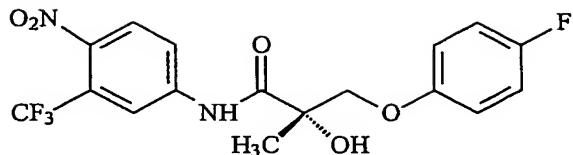
15 28. The method according to claim 1, wherein said SARM compound is a compound represented by the structure of formula VI and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof

20



VI

25 29. The method according to claim 1, wherein said SARM compound is a compound represented by the structure of formula VII I and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof



VII

measuring the UV absorbance of said SARM compound.

35. The method according to claim 30, wherein the detection step comprises measuring the molecular ion peak of said SARM compound by mass spectrometry (MS).

5 36. The method according to claim 35, wherein said mass spectrometry is negative ion mass spectrometry.

37. The method according to claim 30, further comprising the step of determining the concentration of said SARM in each aliquot by comparing the amount of obtained from said aliquot with a reference sample comprising known 10 amounts of a reference SARM compound.

15 38. The method according to claim 30, wherein said chromatographic separation is by liquid chromatography (LC), High Performance Liquid Chromatography (HPLC), Thin Layer Chromatography (TLC), capillary electrophoresis (CE), microLC electrophoresis, nano LC electrophoresis, gel electrophoresis (GE), isoelectric focusing gel electrophoresis, or by sample 20 concentration.

39. The method according to claim 30, wherein said chromatographic separation is by liquid chromatography (LC), and said detection step comprises measuring the molecular ion peak of said SARM compound by mass spectrometry (MS).

40. The method according to claim 30, wherein said chromatographic separation is by High Performance Liquid Chromatography (HPLC), and said detection step comprises measuring the UV absorbance of said SARM compound.

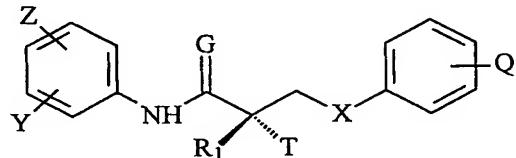
25 41. The method according to claim 30, wherein said chromatographic separation is by liquid chromatography (LC), and said detection step comprises measuring the molecular ion peak of said SARM compound by MS-MS.

42. The method according to claim 30, wherein said chromatographic separation is by capillary electrophoresis (CE), and said detection step comprises 30 measuring the molecular ion peak of said SARM compound by mass spectrometry (MS).

43. The method according to claim 30, wherein said SARM compound is a

compound represented by the structure of formula I and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof

5



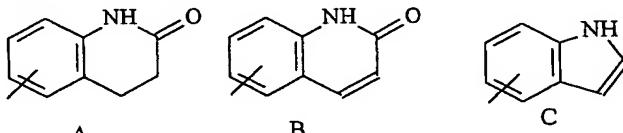
I

wherein

G is O or S;

X is a bond, O, CH₂, NH, Se, PR, NO or NR;T is OH, OR, -NHCOCH₃, or NHCOR10 Z is NO₂, CN, COOH, COR, NHCOR or CONHR;Y is CF₃, F, I, Br, Cl, CN, CR₃ or SnR₃;Q is alkyl, halogen, CF₃, CN CR₃, SnR₃, NR₂,NHCOCH₃, NHCOCF₃, NHCOR, NHCONHR,15 NHCOOR, OCONHR, CONHR, NHCSCH₃, NHCSCF₃,NHCSR NHSO₂CH₃, NHSO₂R, OR, COR, OCOR,OSO₂R, SO₂R, SR, SCN, NCS, OCN, NCO; or Q

20 together with the benzene ring to which it is attached is a fused ring system represented by structure A, B or C:



20

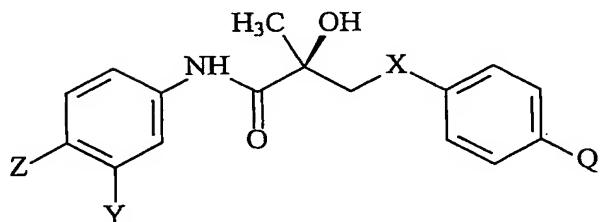
R is alkyl, haloalkyl, dihaloalkyl, trihaloalkyl, CH₂F, CHF₂, CF₃, CF₂CF₃, aryl, phenyl, halogen, alkenyl or OH; and

R₁ is CH₃, CH₂F, CHF₂, CF₃, CH₂CH₃, or CF₂CF₃.

25

44. The method according to claim 30, wherein said SARM compound is a compound represented by the structure of formula II and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical

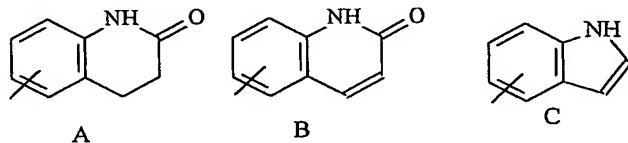
product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof



II

5

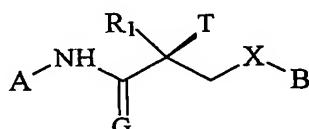
wherein X is a bond, O, CH_2 , NH, Se, PR, NO or NR;
 Z is NO_2 , CN, COOH, COR, NHCOR or CONHR;
 Y is CF_3 , F, I, Br, Cl, CN, CR_3 or SnR_3 ;
 Q is alkyl, halogen, CF_3 , CN, CR_3 , SnR_3 , NR_2 ,
 10 NHCOCH_3 , NHCOCF_3 , NHCOR, NHCONHR,
 NHCOOR, OCONHR, CONHR, NHCSCH_3 , NHCSCF_3 ,
 NHCSR, NHSO_2CH_3 , NHSO_2R , OR, COR, OCOR,
 OSO₂R, SO₂R, SR, SCN, NCS, OCN, NCO; or Q
 together with the benzene ring to which it is attached is a
 15 fused ring system represented by structure A, B or C:



R is alkyl, haloalkyl, dihaloalkyl, trihaloalkyl, CH_2F , CHF_2 , CF_3 , CF_2CF_3 , aryl, phenyl, halogen, alkenyl or OH.

20

45. The method according to claim 30, wherein said SARM compound is a compound represented by the structure of formula III and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof



25

III

wherein X is a bond, O, CH_2 , NH, Se, PR, NO or NR;

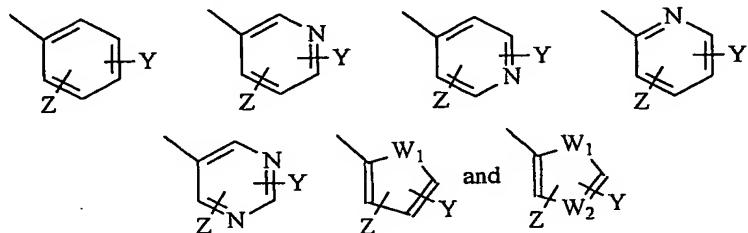
 G is O or S;

R_1 is CH_3 , CH_2F , CHF_2 , CF_3 , CH_2CH_3 , or CF_2CF_3 ;

 5 T is OH, OR, - NHCOCH_3 , or NHCOR ;

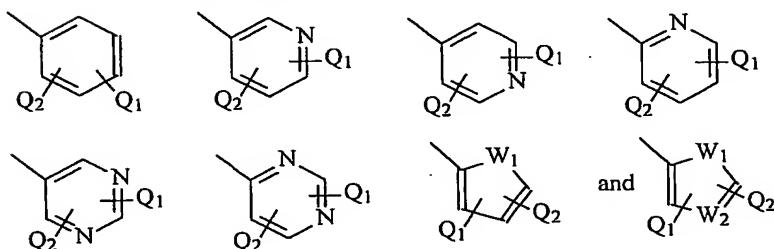
 R is alkyl, haloalkyl, dihaloalkyl, trihaloalkyl, CH_2F , CHF_2 , CF_3 , CF_2CF_3 , aryl, phenyl, halogen, alkenyl or OH;

 A is a ring selected from:



10

 B is a ring selected from:



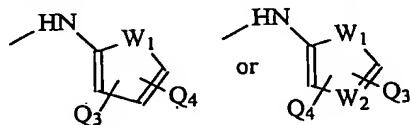
 wherein A and B cannot simultaneously be a benzene ring;

15

 Z is NO_2 , CN, COOH, COR, NHCOR or CONHR ;

 Y is CF_3 , F, I, Br, Cl, CN, CR_3 or SnR_3 ;

Q_1 and Q_2 are independently of each other a hydrogen, alkyl, halogen, CF_3 , CN, CR_3 , SnR_3 , NR_2 , NHCOCH_3 , NHCOCF_3 , NHCOR , NHCONHR , NHCOOR , OCONHR , CONHR , NHCSCH_3 , NHCSCF_3 , NHCSR , NHSO_2CH_3 , NHSO_2R , OR, COR, OCOR, OSO_2R , SO_2R , SR, SCN, NCS, OCN, NCO,



20

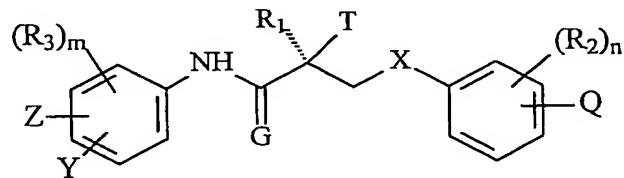
5 Q₃ and Q₄ are independently of each other a hydrogen, alkyl, halogen, CF₃, CN CR₃, SnR₃, NR₂, NHCOCH₃, NHCOCF₃, NHCOR, NHCONHR, NHCOOR, OCONHR, CONHR, NHCSCH₃, NHCSCH₃, NHCSR NHSO₂CH₃, NHSO₂R, OR, COR, OCOR, OSO₂R, SO₂R or SR, SCN, NCS, OCN, NCO;

W₁ is O, NH, NR, NO or S; and

W₂ is N or NO.

10 46. The method according to claim 30, wherein said SARM compound is a compound represented by the structure of formula IV and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof

15



IV

wherein X is a bond, O, CH₂, NH, Se, PR, NO or NR;

20 G is O or S;

T is OH, OR, -NHCOCH₃, or NHCOR;

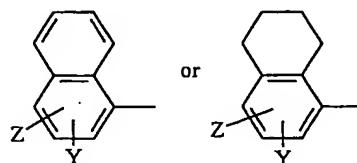
R is alkyl, haloalkyl, dihaloalkyl, trihaloalkyl, CH₂F, CHF₂, CF₃, CF₂CF₃, aryl, phenyl, halogen, alkenyl or OH;

25 R₁ is CH₃, CH₂F, CHF₂, CF₃, CH₂CH₃, or CF₂CF₃;

R₂ is F, Cl, Br, I, CH₃, CF₃, OH, CN, NO₂, NHCOCH₃, NHCOCF₃, NHCOR, alkyl, arylalkyl, OR, NH₂, NHR, NR₂, SR, SCN, NCS, OCN, NCO;

R₃ is F, Cl, Br, I, CN, NO₂, COR, COOH, CONHR, CF₃, SnR₃, or R₃ together with the benzene ring

to which it is attached forms a fused ring system represented by the structure:

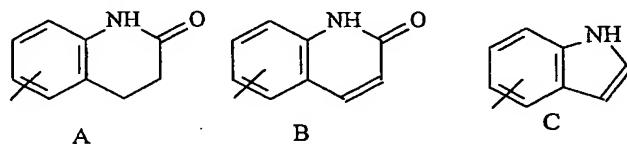


5

Z is NO_2 , CN , COR , COOH , or CONHR ;

Y is CF_3 , F , Br , Cl , I , CN , or SnR_3 ;

10 Q is H, alkyl, halogen, CF_3 , CN CR_3 , SnR_3 , NR_2 , NHCOCH_3 , NHCOCF_3 , NHCOR , NHCONHR , NHCOOR , OCONHR , CONHR , NHCSCH_3 , NHCSCF_3 , NHCSR NHSO_2CH_3 , NHSO_2R , OH, OR, COR, OCOR, OSO_2R , SO_2R , SR; or Q together with the benzene ring to which it is attached is a fused ring system represented by structure A, B or C:

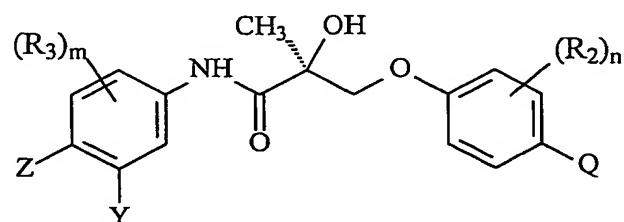


15

n is an integer of 1-4; and

m is an integer of 1-3.

47. The method according to claim 30, wherein said SARM compound is a compound represented by the structure of formula V and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof

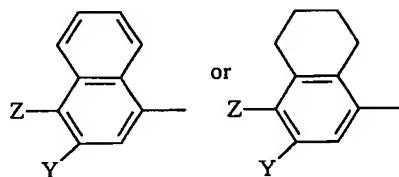


V

wherein

R₂ is F, Cl, Br, I, CH₃, CF₃, OH, CN, NO₂, NHCOCH₃, NHCOCF₃, NHCOR, alkyl, arylalkyl, OR, 5 NH₂, NHR, NR₂, SR;

R₃ is F, Cl, Br, I, CN, NO₂, COR, COOH, CONHR, CF₃, SnR₃, or R₃ together with the benzene ring to which it is attached forms a fused ring system represented by the structure:



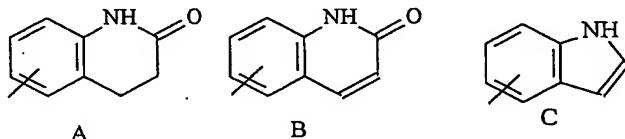
10

R is alkyl, haloalkyl, dihaloalkyl, trihaloalkyl, CH₂F, CHF₂, CF₃, CF₂CF₃, aryl, phenyl, halogen, alkenyl or OH;

Z is NO₂, CN, COR, COOH, or CONHR;

Y is CF₃, F, Br, Cl, I, CN, or SnR₃;

Q is H, alkyl, halogen, CF₃, CN CR₃, SnR₃, NR₂, NHCOCH₃, NHCOCF₃, NHCOR, NHCONHR, NHCOOR, OCONHR, CONHR, NHCSCH₃, NHCSCH₃, NHCSR, NHSO₂CH₃, NHSO₂R, OH, OR, COR, OCOR, OSO₂R, SO₂R, SR; or Q together with the benzene ring to 20 which it is attached is a fused ring system represented by structure A, B or C:



20

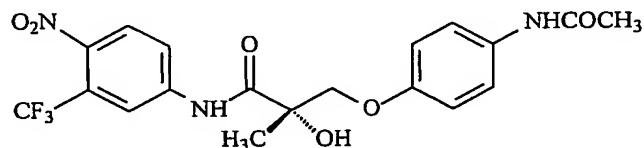
25

n is an integer of 1-4; and

m is an integer of 1-3.

48. The method according to claim 30, wherein said SARM compound is a compound represented by the structure of formula VI and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof

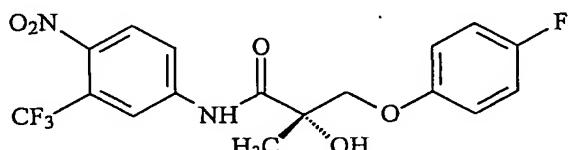
5



VI

10 49. The method according to claim 30, wherein said SARM compound is a compound represented by the structure of formula VII I and/or its analog, derivative, isomer, metabolite, pharmaceutically acceptable salt, pharmaceutical product, hydrate, N-oxide, impurity, prodrug, polymorph, crystal, or any combination thereof

15



VII